OSTEOLOGY OF A SPERM WHALE PHYSETER MACROCEPHALUS (LINNAEUS) FROM CENTRAL QUEENSLAND

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The osteology of a subadult, male sperm whale (12.2m) collected from the central Queensland coast is described. Its mean vertebral length (MVL) is compared with a male specimen from the Japanese coast. There is no appreciable difference in vertebral proportions, particularly in the caudal region, between these specimens from the Northern and Southern Hemispheres. \Box *Sperm whale, Physeter macrocephalus, osteology.*

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A male sperm whale (12.2m) stranded at Joskeleigh Beach via Keppel Sands (150°48'E, 23°19'S) on 3 Oct. 1995, and died the following day. A Queensland Museum (QM) team arrived at the site on 6 Oct. (Fig. 1). The carcass was flensed and the skeleton collected. The specimen is registered as QMJM11149.

DESCRIPTION

TEETH. Three vestigial maxillary teeth (others were almost certainly present but were lost during flensing) as well as the mandibular teeth were collected (Fig. 2; Table 1). There are 23 right and 23 left mandibular teeth. Beale (1839) counted 24-24 in a specimen from Hull, England. Flower (1869) examined several specimens in the Museum of the Royal College of Surgeons in London and recorded counts of 20-21 (many teeth were worn and perhaps some were lost), 23-24 and 26-26. Omura et al. (1962) counted 24-24 in a Japanese specimen. One of the first mandibular teeth of QMJM11149 was prepared in section according to Lockyer (1981) and the age estimated at 20 years compared with 32 for the 13.8m male specimen described by Omura et al. (1962).

SKULL. The skull, mandible and hyoid structures [from Omura et al. (1962)] are illustrated in Figs 3 & 4A (measurements, Table 2).

VERTEBRAE. The vertebral formula is C7; D11; L8; Ca25 = 51 compared with C7; D11; L8;



FIG. 1. Sperm whale at Joskeleigh Beach, central Qld coast, 6 Oct., 1995.

Ca24 = 50 for the Tasmanian and Japanese specimens described by Flower (1869) and Omura et al. (1962) respectively. Vertebrae are illustrated laterally in Fig. 5A-E. Fusion of C2-7, characteristic of the species, is demonstrated. A minor developmental anomaly in the spinous process of L6 is has failed to fuse.

evident. It is elongated and its tip FIG. 2. Teeth of QMJM11149. Mandibular teeth from right side in upper row and left in lower row. The three vestigial maxillary teeth are shown separately in the lower right. (Scale = 1m)

The vertebral measurements and the mean vertebral length

(MVL) of the Japanese specimen (Omura et al., 1962), are contained in Table 3. $MVL = (a \times b \times x)$ c) $^{1/3}$ where a, b and c represent the breadth, height and length respectively, of the centra. It was used by Omura (1971) when comparing different baleen whale species. We see no objection to the application of this formula to sperm whales. A comparison between the MVL of QMJM11149 and the Japanese specimen is shown in Fig. 6. (Some difficulty was experienced in co-relating measurements in the cervical vertebrae and, accordingly, those of QMJM11149 have been omitted.)

There are eleven chevrons (Fig. 5F; Table 3). Despite careful dissection, no pelvic bones were recovered, however, a bony structure considered to be a rudimentary femur (Fig. 4B; Table 3) was collected.

RIBS AND STERNUM. There are eleven pairs of ribs (Figs 4C & 7; Table 4). The central foramen in the sternum is noted in the descriptions by Flower (1869) and Omura et al., (1962) and in QMJM9920 (this study). The distal sternal elements in the above specimens show considerable individual developmental variation.

SCAPULAE AND FORELIMBS, Scapulae and forelimb bones are illustrated in Fig. 8 (measurements, Table 5). The phalangeal formula (including the metacarpals) is I2, II5-6, III5, IV4, V3-4 compared with I1, I15, 1II5, 1V4, V3 in the specimen described by Omura et al. (1962).

DISCUSSION

The sperm whale was the most widely hunted cetacean in the 19th and 20th centuries. The question of possible sub-specific status, on the basis of osteological and external features, has interested researchers for more than a century (Flower, 1869). Berzin (1971) noted: 'The only consistent difference found between populations

is that animals from the southern hemisphere have a slightly longer caudal region than those from the northern hemisphere'. Clarke & Paliza (1972) concluded, on the basis of extensive material collected during whaling operations, that sperm whales from the SE Pacific, Japan, the Bonin 1. and Durban are not different in their morphometry and accordingly, based on the method of body proportions, did not accept that there are northern and southern sub-species of the sperm whale.

The central epiphyses of the distal caudal vertebrae of QMJM11149 are almost completely fused and presumably further vertebral growth, if the animal had survived, would have occurred predominantly in the dorso-lumbar and proximal caudal vertebrae given the non-fusion of the central epiphyses at those levels (Fig. 5A-D). The MVL of QMJM11149 when compared with the slightly longer male from the Japanese coast (Fig. 6) does not demonstrate a proportional difference in caudal length. On the available osteological data, we are unable to detect any significant difference between the northern and southern hemisphere sperm whale populations.

ACKNOWLEDGEMENTS

Steve Van Dyck organised the retrieval of QMJMIII49. Kylie and Paul Stumkat and Robert Wallace assisted with flensing. Their valuable assistance is much appreciated. Staff at the Luggage Point Wastewater Treatment Plant at Pinkenba kindly allowed us to store the skeleton there during cleansing and ensured its safety. Jeff Wright and Vincent Railton took the photographs.

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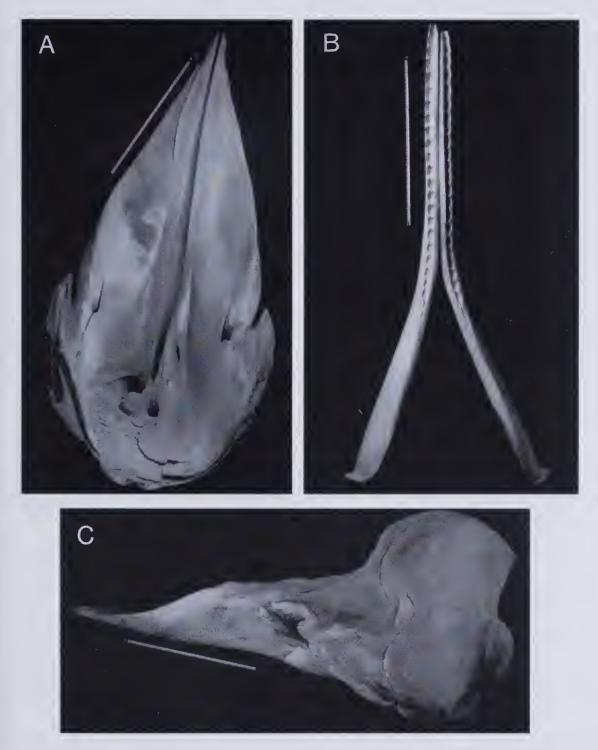
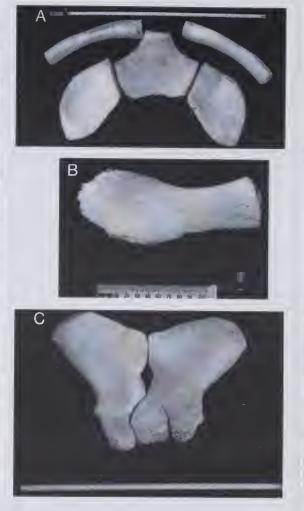


FIG. 3. QMJM11149. A, skull from dorsal aspect; B, mandible from dorsal aspect; C, skull from lateral aspect. (Scales = 1m)

- wom.										
Mandib -ular Teeth	Lei	ngth	cavun	eter of dentis posterior)	Diameter of cavum dentis (transverse)					
1000	L	R	L	R	L	R				
1	88	91*	26	20	17	22				
2	88	102*	29	33	20	38				
3	101	115	34	42	25	35				
2	107	124	37	47	28	35				
8	109	125	30	38	38	37				
8	109	122	42	52	33	34				
7	108	115	44	52	31	36				
8	102	115	38	52	35	37				
8	116	107	51	34	36	38				
10	109	117*	35	53	34	37				
14	114	109	50	32	37	38				
12	114	112	51	37	38	38				
13	116	116	55	38	39	38				
14	115	114	53	49	38	35				
15	114	95B	55	48	38	37				
18	121	114	54	48	47	35				
17	115	97B	50	34	38	35				
18	114	103*	- 38	43	36	31				
10	114	95*	48	35	35	27				
20	124	105	35	38	36	30				
21	111*	101	38	38	38	28				
22	107	94	42	31	29	29				
20	37	80*	20	31	49	18				
Maxilla	y Teeth									
20	5	8	1	7	14					
25	4	6	1	5	12					
26	5	0	1	4	11					

TABLE 1. Mandibular and vestigial maxillary teeth measurements (mm) of QMJMII149. B = broken, * = worn.



- FIG. 4. QMJMIII49. A, hyoid components; stylohyals (uppermost), basihyoid (centre), thylohyals (lowermost) (scale = 1m). B, femur (scale in cm). C, sternum (scale = 1m).
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f maxillae	Diameter of orbit (antero-posterior)	R: 14
Greatest breadth across post-orbital processes 147	Greatest breadth across supra-orbital plates of maxillae	137
	Greatest breadth across post-orbital processes	147

TABLE 2. Skull, mandibular and hyoid measurements (cm) of QMJM11149. * = damaged, # = damaged at tip.

Greatest breadth of cranium at part in temporal fossae	ietal region	114						
Length of temporal fossae		L: 32						
		R:*						
Depth of temporal fossae		L: 14						
Deptit of temporal tossae		R: *						
Breadth of occipital condyles	49							
Breadth of foramen magnum		12						
Length of occipital condyle		L:32						
Length of occipital condyre		R: 34						
Height, vertex to inferior border of	of pterygoids	109						
		L: 14						
Depth of orbit		R: 14						
T		L: 269#						
Length of mandibular ramus		R: 269#						
Distance from anterior end of man	ndible to	L: 242#						
coronoid process		R: 247#						
The Contraction		L: 142						
Length of symphysis		R: 141						
Distance from anterior end of man	ndible to	L: 164						
posterior end of alveoli		R: 164						
Greatest height of mandible at con	ronoid	L: 43						
process		R: 42						
Distance between mandibular con	idyles	111						
Distance between ear bones		70						
Breadth of posterior end of pteryg	goids	17						
Breadth of anterior end of pterygo		49						
		L: 41						
Length of malar bone		R: 41						
Hyoid	Hyoid Greatest Length							
Stylohyal, right	7							
Stylohyal, left								
Basihyoid	49							
Thylohyal, right	40.5	24						
Thylohyal, left	42	23						

	Greatest Breadth	ight	Centrum Breadth (a)	Centrum Height (b)	Length	M11149 (x c) $x = c$	ese			Greatest Breadth	ght	Centrum Breadth (a)	ight	ıgth	49	se
No	Bre	Hei	Br	1 He	1 Le	411 c) ^{1/2}	pane		No	Bre	Hei	Bre	Hei	Ler	6) (1)	pane
Vertebra No.	atest	Greatest Height	trun	trun	Centrum (c)	MVL JMI $(a \times b \times c)$	MVL Japanese specimen		Vertebra No.	atest	Greatest Height	unn	Centrum Height (b)	unu	NV 7	Jal
Ver	Gre	Gre	(a) Cen	(cen	(Cen	MVL (a × b	MV spec		Vел	Gree	Gre	(a)	(b) (b)	Centrum Length (c)	MVL JM11149 $(a \times b \times c)^{1/3}$	MVL Japanese specimen
C1	683	394	#	#	#	#	127		10	221	325	205	220	212	212	230
2-7	637	438	#	#	#	#	243		11	212	287	198	213	186	199	204
D1	437	414	237	171	109	164	208		12	203	244	188	200	169	182	173
2	436	151	203	109	126	169	190		13	185	200	172	170	118	151	135
3	409	471	200	193	127	170	197		14	153	152	142	130	83	115	115
3	391	478	190	189	132	170	185		15	151	130	125	112	79	193	104
5	384	480	190	181	140	169	186		10	154	125	109	109	74	90	90
6	363	479	190	170	145	109	186		17	140	113	85	90	79	81	80
7	335	494	197	183	148	175	197		10	121	109	85	80	64	74	76
8	323	499	198	185	162	181	198		19	162	85	74	85	55	64	66
9	378	508	195	185	170	183	190		20	82	73	65	54	49	56	56
10	479	541	202	186	177	188	212		21	85	81	\$5	37	64	32	53
11	520	545	219	203	109	203	221		22	54	56	37	30	10	37	42
L1	491	557	200	207	197	203	219		23	\$5	30	33	10	27	30	35
2	480	594	209	207	218	211	233		24	29	23	21	10	10	49	24
3	505	589	209	209	245	211	244		25	14	13	12	10	10		
3	518	596	210	210	227	218	200		Chev	vron	Grea		Grea			
5	531	608	213	220	240	220	254				Len	-	Wie			
8	547	615	213	225	230	225	251			-	40		10			
7	556	594	214	228	252	231	252		2		10		18			1
8	567	583	221	232	272	241	263		3		39		19			
Cal	561	589	227	233	258	239	273	ŀ	2		37	_	18			
2	554	508	236	239	279	251	276	-	5		34	-	19			
3	535	572	242	243	291	258	276	ŀ	8		28		18	-		
9	490	550	253	245	200	253	279		7		24		10			
5	531	525	252	211	282	258	281		8		10	-	10			
8	373	482	258	245	276	257	277	ŀ	8		10	-	15			
7	320	425	235	237	247	200	265	-	1(12		10	(
8	268	384	232	230	233	232	258	1	10	-	10		ž(
9	237	357	215	222	225	221	241	L	Fen	nur	17	9	10)		

TABLE 3. Vertebral, chevron, femoral measurements (mm) and MVL of QMJM11149, MVL of the Japanese specimen. # = unable to calculate.

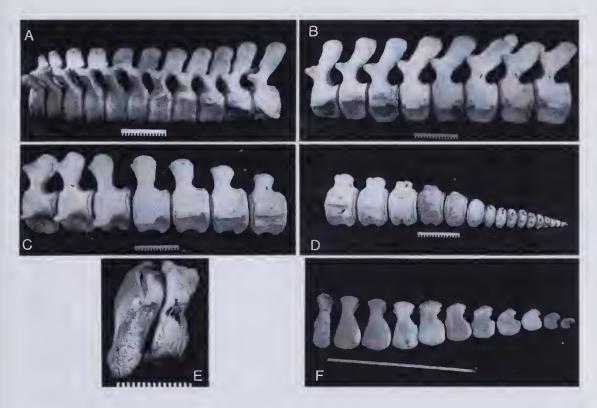


FIG. 5. Vertebrae of QMJM11149 from lateral aspect; A, dorsal; B, lumbar; C & D, caudal; E, cervical; (scales in cm). F, chevrons (scale = 1m).

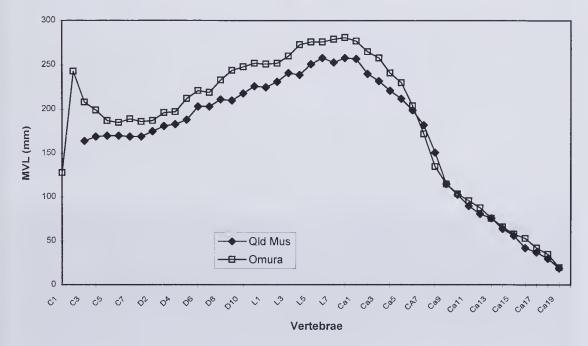


FIG. 6. Comparison between mean vertebral lengths (MVL) of QMJM11149 and the Japanese specimen (Omura et al., 1962).

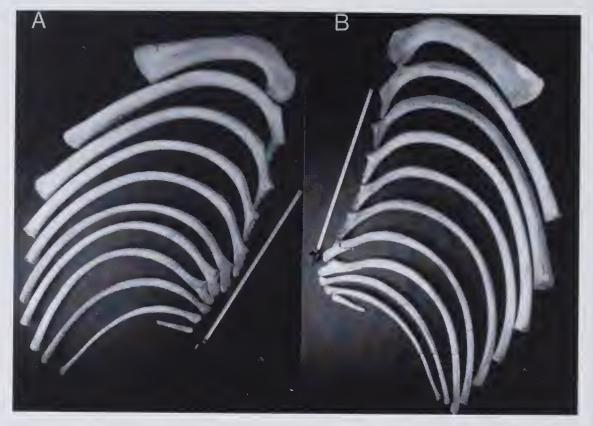


FIG. 7. Ribs of QMJM11149; A, left; B, right. (Scale = 1m)

Rib	Straight	Length	Rib	Straight Length			
	Left	Right	KIU	Left	Right		
1	93	94	9	123	114*		
2	129	128	9	112	110		
3	142	141	10	95	94		
4	142	139	11	22	23		
5	135	133	Sternum	Greatest Length	Greatest Width		
6	135	130	Left side	58	42		
7	128	126*	Right side	54	42		

TABLE 4. Rib and sternal meas	surements (cm) of	f QMJM11149.	* = damaged.
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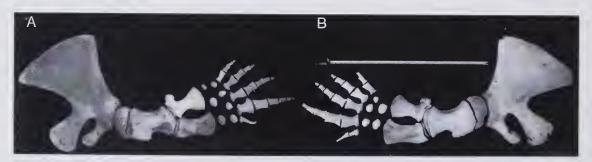


FIG. 8. Scapulae and forelimb bones of QMJM11149; A, left; B, right; (scale = 1m).

		Scapula			Humerus, Radius, Ulna							
Left Right							Width	at centre	Le	ngth		
Gre	eatest Brea	dth	545	550			Left	Right Left Rig				
Gr	eatest Len	gth	615	605	Hur	nerus	130	130	370	367		
					Radius		114	93	258	256		
					Ulna		81	88	244	234		
				Leng	th of Phala	inges						
Phalanx			Left		Right							
	I	II	III	IV	V	V	II	III	IV	I		
I	63	99	99	99	99	61	101	103	63	73		
2	51	88	74	65	52	88	93	90	69	53		
3		67	57	48	30		76	62	51	33		
4		45	38	31	18		49	39	33	*		
5		30	24				33	27				
6		14										

TABLE 5. Scapular and forelimb measurements (mm) of QMJM11149. * = possibly missing.